

REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-26 are presently active in this case, Claim 1 having been amended by the present amendment.

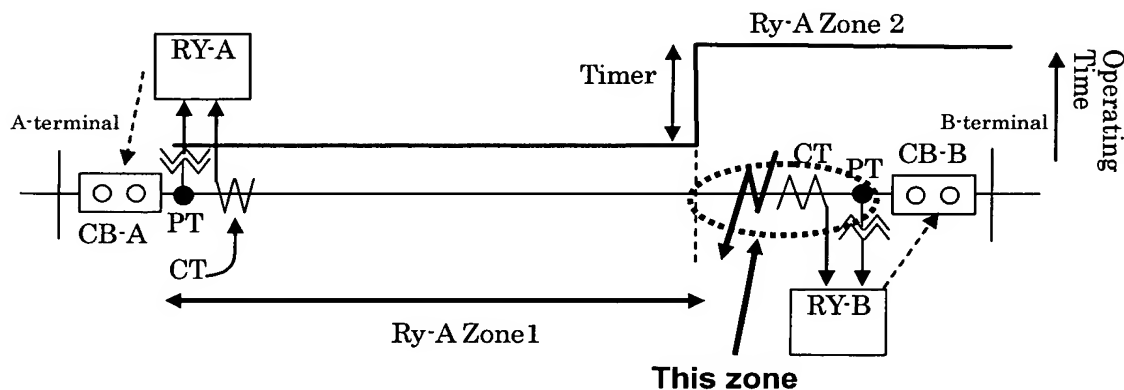
In the outstanding Official Action, Claims 1-3 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Maeda et al. (US 5,796,630, hereinafter called "Maeda") and in further view of Bo (US 6,369,996 B1); Claims 7 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Maeda and Bo and in further view of Eijiro et al. (JP 03-270634, hereinafter called "Eijiro"); Claims 15 and 19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Maeda and Bo in further view of Yamaura et al. (US 4,419,737, hereinafter called "Yamaura"); and Claims 4-6, 8-10, 12-14, 15-18, 20-22 and 24-26 were objected to as being dependent upon a rejected base Claim, but were otherwise indicated as including allowable subject matter if rewritten in independent form.

Applicants acknowledge with appreciation the indication of allowable subject matter. However, since Applicants consider that the pending Claims are patentable over the cited prior art, Claims 4-6, 8-10, 12-14, 15-18, 20-22 and 24-26 have presently been maintained in dependent form.

Applicants respectfully traverse the outstanding grounds for rejection, for the following reasons.

Maeda discloses a method of measuring the impedance of a distance relay. This measurement can be performed by a high-precision computation technique.

Bo discloses a technique of detecting a fault in a zone, which is labeled “**This zone**” shown in Reference Figure 1 below, which is included in a protected zone and cannot be protected in Zone 1, at higher speed using only information of one terminal of the protected zone, and then protecting the fault.



Reference Figure 1

Originally, a protective relay is designed to detect all faults in a protected zone (between a circuit breaker and a circuit breaker) at high speed and outputs a trip signal to the circuit breakers. On the other hand, a distance relay computes the distance to a fault point on the basis of measured voltage and current. If the distance falls within a predetermined distance (setting range: Zone 1), the distance relay outputs a trip signal to a circuit breaker at high speed. If the fault point is located beyond the setting range, the distance relay outputs a trip signal with a delay of about several hundred seconds by a timer, and then trips. The predetermined distance (setting range: Zone 1) is usually set to about 80% of the whole line in consideration of errors of measurement.

If, therefore, a fault occurs in the remaining 20% zone (“**This zone**” in Reference Figure. 1) that is beyond the setting range (Zone 1), the trip will have a delay of several hundred seconds. To prevent this, a direction comparison method using communications is

generally applied. In this method, the relay trips if a fault occurs in the forward direction or the backward direction of either end (terminal) of the protected zone. Therefore, a fault in the whole line is detected at high speed and no trip is delayed; however, communications facilities are required.

In contrast, the relay of Bo detects a fault in the 20% zone (“**This zone**” in Reference Figure. 1) that is beyond the setting range (Zone 1) with little delay, without using any communications facilities, and trips.

Ejiro discloses a technique of preventing an undesired operation due to an operation time lag (described later) in a distance relay. In most cases, a distance relay is achieved by a combination of a directional element for detecting the direction of a fault and a distance-measuring element for measuring the distance to the fault. Assume that a fault occurs in the forward direction (beyond Zone 1) and, in this case, the directional element operates, while the distance-measuring element does not operate. Assume here that the fault is tripped by another relay. A fault current is interrupted and a load current starts to flow normally. If only the load current flows, the distance-measurement element often operates, but the directional element does not operate. Accordingly, no problems occur under normal circumstances.

If, however, a change of the distance-measuring element from non-operation to operation is earlier than that of the directional element from operation to non-operation when a distant fault is eliminated, both the elements may operate instantaneously. It can be considered that when both the elements operate, the trip conditions are met and the relay is tripped. This is generally called an operation time lag. It is necessary for the relay to wait for the trip conditions to be met or to wait for the operation of the distance-measuring element. It is quite difficult to determine how long the relay is waiting. Ejiro therefore aims at setting a delay on the basis of the detection of variations in current.

Yamamura simply discloses a configuration of a commonly-used digital protective relay.

In contrast to the prior art, the Claimed invention aims at detecting a fault (close-end fault), which occurs at a point (within a range narrower than zone 1) relatively close to a relay, at high speed and tripping the fault.

According to the foregoing descriptions of Bo, the protected range in Zone 1 is usually set to about 80% of the whole length of a line. However, in order to detect a fault within the 80% range with reliability and not to detect a fault beyond the whole length (100%) of the line absolutely, considerably higher precision is required. Since precision and speed are mutually contradictory, they are difficult to improve greatly.

An object of Applicants' invention is therefore to detect a fault, which occurs at a location close to a relay within a range narrower than zone 1, at high speed by providing a "fault detecting relay element" whose operating time has higher priority than precision. This "fault detecting relay element" never operates when a fault occurs outside the protected zone, because the set range of fault detection is narrow.

As described above, the present invention aims at detecting a fault (close-end fault), which occurs within a range narrower than zone 1, at high speed and tripping the fault. Consequently, the present invention is different than each of Maeda, Bo, Ejjiro, and Yamaura in technique, object and function, such that even if these references are combined, it is respectfully submitted that the Claimed invention is not obviated by the combined teachings of these references.

At page 3, lines 2 to 5 of the outstanding Official Action, the Official Action states the position that Bo describes a fault within a zone that is narrower than that of the zone-1 distance relay element in terms of data time length which is shorter than that used for the

computation of the zone-1 distance relay element. Such a description is not however found in Bo.

As described above, Bo detects a fault within a protected zone ("This zone") beyond Zone 1 under conditions other than those in Zone 1. The present invention detects a fault (close-end fault) within a narrow range included in zone 1 and close to a relay earlier than that in zone 1. Bo therefore differs from the present invention in object.

Claim 1 recites that a "fault detecting relay element" performs computation to detect a fault in a range narrower than zone 1 at high speed using data of time length (window length) which is shorter than that of data used for the computation of zone 1. Neither Maeda nor Bo teach or suggest any structure equivalent to that recited in Claim 1. In Applicants' view, Claim 1 in fact recites structure which is totally different from that disclosed by Maeda and Bo in object and technique, and therefore it is respectfully submitted that Claim 1 patentably distinguishes over these references.

Since Claims 2, 3, 7, 11, 15, 19 and 23 are all dependent directly from Claim 1, these Claims are likewise believed to be patentably distinguishing over the cited prior art. Furthermore, these Claims are believed to state further patentably distinguishing features.

Claim 2 recites a "fault detecting relay element" to detect a fault within a range narrower than zone 1 using digital filters whose response time is shorter than that in zone 1. Neither Maeda nor Bo includes any equivalent teaching, such that even if these references are combined, the Claim 2 patentably distinguishes over these references.

Claim 3 recites that a "fault detecting relay element" performs computation to detect a fault within a range narrower than zone 1 at high speed using data of time length which is shorter than that of data used for the computation of zone. Neither Maeda nor Bo includes any equivalent teaching, such that even if these references are combined, the Claim 3 patentably distinguishes over these references.

As is apparent from the above, it is respectfully submitted that Claim 23 is also patentable over the cited references.

With regard to the rejection of Claim 7, the outstanding Official Action states that Eijiro discloses a mho type distance relay having a setting value that is smaller than that of zone 1. However, it is respectfully submitted that such a disclosure is not found in Eijiro. Furthermore, Maeda and Bo basically differ from the present invention in object and technique as described above.

Claim 7 recites a mho relay having a setting value that is smaller than that of zone 1 as a specific "fault detecting relay element" in Claim 1. Maeda, Bo and Eijiro do not disclose or obviate such structure. Even though these references are combined, the present invention cannot be obtained. Since Claim 7 depends from Claim 1, it is patentable as well. Maeda, Bo and Eijiro include no equivalent teaching, such that even if these references are combined, the Claim 7 patentably distinguishes over these references.

With regard to the rejection of Claim 11, the outstanding Official Action states that Eijiro discloses a reactance type distance relay having a setting value that is smaller than that of zone 1. Such a disclosure is not found in Eijiro. Furthermore, Maeda and Bo basically differ from the present invention in object and technique as described above.

Claim 11 recites a reactance relay having a setting value that is smaller than that of zone 1 as a specific "fault detecting relay element" in Claim 1. Maeda, Bo and Eijiro include no equivalent teaching, such that even if these references are combined, Claim 11 patentably distinguishes over these references. Furthermore, since Claim 11 depends from Claim 1, it is patentable as well on that basis.

With regard to the rejection of Claim 15, the outstanding Official Action states that Yamaura discloses an undervoltage relay. The undervoltage relay is well-known irrespective of the disclosure of Yamaura. Furthermore, Maeda and Bo basically differ from the present invention in object and technique as described above.

Claim 15 recites an undervoltage relay used as a specific "fault detecting relay element" in Claim 1. It is respectfully submitted that Maeda, Bo and Yamaura include no such teaching. Therefore, even if these references are combined, Claim 15 is believed to be patentably distinguishing thereover. Furthermore, since Claim 15 depends from Claim 1, it is patentable as well on that basis.

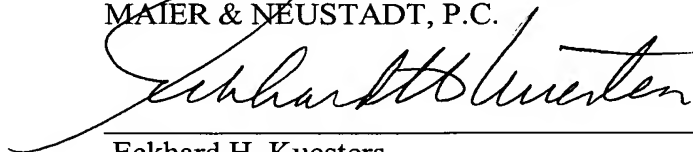
With regard to the rejection of Claim 19, the outstanding Official Action states that states that Yamaura discloses an overcurrent protection relay. The overcurrent protection relay is well-known irrespective of the disclosure of Yamaura. Furthermore, Maeda and Bo basically differ from the present invention in object and technique as described above.

Claim 19 recites an overcurrent relay used as a specific "fault detecting relay element" in Claim 1. Maeda, Bo and Yamaura include no such teaching. Therefore, it is respectfully submitted that Claim 19 also patentably defines over the cited prior art.

Consequently, in view of the present amendment and in light of the above comments, no further issues are believed to be outstanding, and the present application is believed to be in condition for allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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